

Surface Circulation of the North Atlantic and Lake Erie: A Model

Introduction

The ocean and Great Lakes interact closely with the atmosphere. Heat from the sun, evaporative, conduction and emission forces provide energy for ocean movement, while wind and density differences provide momentum. Changes in atmospheric pressure set up wind patterns. Predominant wind patterns are among the main forces which drive circulation. The shapes of the coastline and bathymetry differences cause changes in direction (meanders) and spin-offs (gyres) from the main current. These gyres are visible in maps of sea surface temperatures of the Gulf Stream in the North Atlantic (<http://fermi.jhuapl.edu/avhrr/gs/averages/>). In this activity, students will explore how wind forces water movement and how land features can change this movement.

Objectives:

- 1. Participants will become familiar with the forces which produce the circulation patterns in lake or ocean basins.*
- 2. Participants will be able to predict current patterns or eddy development with variances in bathymetry.*

North Atlantic Application

Materials:

Heavy duty stainless steel baking tray (10 x 16)

Modeling clay

Laminated satellite images of the Gulf Stream

Laminated Bathymetric maps of the North Atlantic

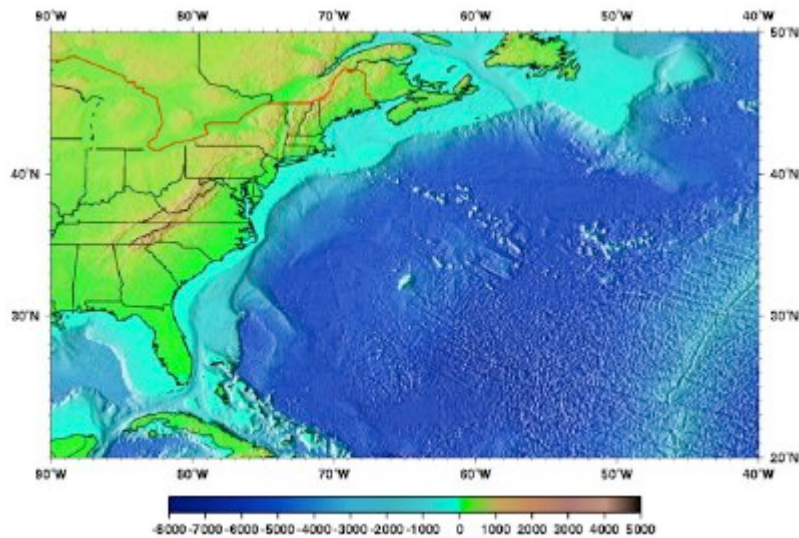
Convection Fluid Bottles, Carolina Biological Supply Catalog #, Price, Qty. GEO8450,

Hair Dryer

Procedure:

1. In groups of 3-5, use clay to build a model of the North Atlantic. Use the bathymetric maps below and be sure to include the continental shelf, continental slope, capes, seamounts, and other seafloor features.
Maps: Bathymetry of the North Atlantic
2. Create the shoreline of the North Atlantic in your container using the clay. (no more than 1-2 inches thickness of clay on edges).
3. Pour in a diluted solution of Convection Fluid to a depth which just covers the subsurface oceanic features.
4. Set up a gentle "wind" blowing from the south to start a current. Make observations on the current patterns that develop.
5. Change wind direction and speed and observe any changes in the current patterns.
6. Illustrate your notes on the observations, especially the patterns affected by the shoreline or around surface features (e.g. Cape Hatteras).
7. When finished, return the Convection Fluid to the container. Remove clay from container and roll into ball.

Bathymetry of the North Atlantic



http://oceancurrents.rsmas.miami.edu/atlantic/img_topo2/gulf-stream2.jpg

Surface Circulation of the North Atlantic Worksheet

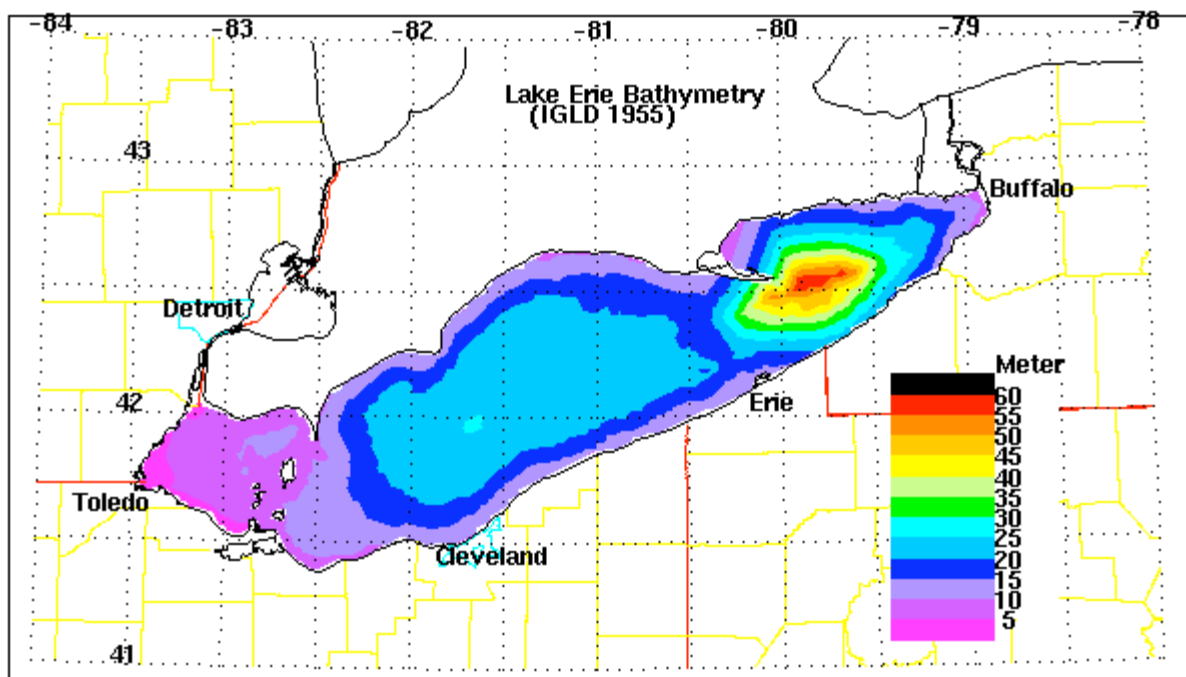
1. Did the shelf, slope or capes affect the surface current? Describe.
2. Do you think the Gulf Stream might have a greater affect on weather of the southeast vs. the northeast of the USA? Explain.
3. What other factors besides wind might affect the Gulf Stream current?

Great Lakes Application (Lake Erie)

Procedure:

1. In groups of 3-5, use clay to build a model of the lake. Use the bathymetric maps below and be sure to include the shore line, islands, and bottom features of the lake.
2. Create the shoreline of Lake Erie in your container using the clay. (no more than 1-2 inches thickness of clay on edges).
3. Pour in a diluted solution of Convection Fluid to a depth which just covers the subsurface lake features.
4. Set up a gentle "wind" blowing from the south to start a current. Make observations on the current patterns that develop.
5. Change wind direction and speed and observe any changes in the current patterns.
6. Illustrate your notes on the observations, especially the patterns affected by the shoreline or around surface features (e.g. Point Pelee).
7. When finished, return the Convection Fluid to the container. Remove clay from container and roll into ball.

Bathymetry of Lake Erie



Surface Circulation of Lake Erie Worksheet

1. Did the shelf, slope, points, or islands affect the surface current? Describe.
2. Do you think the lake currents might have a greater affect on weather south vs. the north of the lake? Explain.
3. What other factors besides wind might affect the lake current?

Suggested critical thinking questions:

Is the surface circulation of the Great Lakes and the Ocean affected by the same parameters?

How does Ocean circulation differ from Great Lakes circulation?

